



## Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact [support@jstor.org](mailto:support@jstor.org).

## MALARIA IN ENGLAND IN 1917 AND 1918.

AN ANALYSIS OF REPORTS AND PAPERS ON MALARIA CONTRACTED IN ENGLAND IN 1917 AND 1918, ISSUED BY THE LOCAL GOVERNMENT BOARD.

By H. R. CARTEE, Assistant Surgeon General, United States Public Health Service.

The reports and papers on malaria, issued by the Local Government Board, give the "reaction" of England to the importation of a large number of men infected with malaria in 1916, 1917, and 1918, so far as has been determined up to June, 1919—the date of the last paper. They are of interest to us in America, especially to those in regions in which malaria was, but is no longer, prevalent. The reports on the current year and the two or three following ones will be of even greater interest.

In the past, malaria was prevalent in many parts of England to such an extent as to be of "serious sanitary importance." Shakespeare is full of allusions to ague. James I and Charles II both suffered from it, and Cromwell died of a tertian fever. The Lincolnshire Fens and parts of Kent especially enjoyed (?) a bad reputation, and, I presume, there was a certain immunity among the natives, as a Fen man is exhorted not to take a wife "out-foreign," because she "was sure to die of ague"—the speaker, a Fen man (and a fictitious character) having had this ill luck three times. In some sections—as in Kent, south of the lower Thames—malaria was prevalent up to 1869–70, and maybe longer. England was generally believed to be free from it at the time of the beginning of the war.

Nuttall, Shipley, and Strangeways Pigg<sup>1</sup> found *Anopheles* of three species quite commonly distributed in the low-lying parts of England, one species of which, *A. maculipennis*—the Old World analogue of our *quadrimaculatus*—is known to be elsewhere an efficient vector of malaria. Unfortunately, attention was concentrated rather on the fact of finding *Anopheles* than on the number found, i. e., whether they were numerous enough to be "of sanitary importance." So the surprise of these gentlemen at the absence of malaria in England, in spite of its frequent introduction from abroad, is, I think, not justified by their findings as published.<sup>2</sup>

The unknown "third factor" (in addition to *Anopheles* and infected men) predicated as necessary for the conveyance of malaria, and which was absent in England, may have been in many cases a temperature for much of the time so low that the full development of the parasite in the mosquito took place either not at all or so slowly as to materially reduce the efficiency of the insect as a vector. *Anopheles*, of course, may be active at a temperature well below the optimum of that for the development of the parasite in them.

<sup>1</sup>Journal of Hygiene, 1901 to 1903.

<sup>2</sup>The survey implies, however, a considerable—or even large—amount of breeding at some places.

The factors necessary for the conveyance of malaria are obviously:

- (1) Men infective to *Anopheles* mosquitoes;
- (2) Active *Anopheles* of sufficient numbers to serve as vectors;
- (3) Temperature suitable for the full development of the parasite in the mosquito; and
- (4) Men accessible to the infective mosquitoes.

In 1916, 1917, and 1918 a large number of men suffering from malaria were brought to England from the Balkans, Gallipoli, and, I presume, from Palestine and Egypt. How many one can only guess. In the report made in March, 1918, by Ross, 2,460 cases were reported in 1917 as undergoing, in the hospital, specially devised therapy to prevent relapses. The total number under treatment must have been several times more than this. Angus MacDonald, in the paper reviewed, reported 2,417 "proven carriers" (by blood examination ?) at three places only, at which malaria had been contracted in 1917. He says the "actual number was obviously much greater." A conservative estimate would be that from 10,000 to 20,000 men infected with malaria were introduced into England in 1916 and 1917, fewer in 1918—probably 15,000 to 25,000 in all. And they were pretty well scattered in England, too—in camps, villages, and small towns. Very obviously there was abundant material to infect *Anopheles* if other conditions were suitable, and they were so infected. During 1917 and 1918 malaria was reported to have been contracted in England as follows:

Year.	Total cases for year.	Cases in Army.	Cases in Navy.	Civilian cases.
1917.....	231	163	25	43
1918.....	95	61	9	25
Total.....	326	224	34	68

Twenty-nine foci of infection were established; all cases were tertian—the "benign tertian" of British writers—although from 26 per cent to 32 per cent of the infections at the places of origin were æstivo-autumnal—"malignant tertian." We may note here (1) that this form seems to be less apt to relapse and (2) that it certainly requires a higher temperature for sporogony than the simple tertian. Two hundred and seventy of the cases occurred in Kent—234 in the three districts, Sheppey (an island south of the mouth of the Thames), the Isle of Grain, and Sandwich.

At first the infection was, naturally, considered as being derived entirely from the imported infection; but a closer examination showed its existence, and in some amount, in Queensborough (in the Sheppey District) and in the Isle of Grain prior to the advent of the soldiers.<sup>1</sup>

<sup>1</sup> It existed also in the Romney Marsh area as late as 1911.

This is not asserted of Sandwich, although Sandwich is in the same general section. The later conclusion was, then, that a certain number of these cases were true indigenous infections, and that the remainder were contracted, through English Anopheles, from the soldiers who had been infected overseas.

S. P. James is very positive in claiming a marked clinical difference between the indigenous infections and the imported ones; the first being far milder and little subject to symptomatic relapse, and the second being extremely severe and having frequent relapses. No difference in the morphology of the parasites was detected. The Sandwich cases were, in general, mild—as mild as those from Queensborough. By this test a number of them would then count as indigenous infections. It seems, then, that malaria was not *entirely* absent from England at any time, but that it lingered in very mild form in a few places, and was discovered as a result of the careful investigation which was prompted by cases of malaria being contracted in England and showing among the troops and civilians in contact with the troops.

The report shows that no control measures likely to be sufficient to prevent the spread of malaria in 1917 were taken. For 1918 measures of control were much better applied. In the Sheppey district, Sandwich, and Romney Marsh, where the great bulk of the cases occurred, measures for the control of mosquito production were undertaken. Generally, however, the measures undertaken were the prompt reporting of cases and their sterilization by quinine, Col. James formulating the treatment.

To my mind the point in these papers which stands out as of prime importance is that, *with the importation of not less than 15,000 men infected with malaria during three years, the total number of cases reported as contracted in England in two years was only 326*, some of which were contracted from preexisting (indigenous) infection. Very obviously malaria shows little tendency to spread in England.

This will be better seen if we look at the statistics for 1917 by themselves, as the measures for control of that year may, I think, be almost disregarded. From 10,000 to 15,000 infected men were imported and there were only 231 cases contracted in England (43 among civilians). If these conditions of conveyance continue, the malaria introduced in 1917 will be “of no sanitary importance” within a year or two.

I think we may take it as a rule, *if the biological conditions of the insect host are such that malaria, once prevalent, spontaneously disappears, that while the introduction of carriers—no matter in what number—may cause an outbreak of malaria, this outbreak will be temporary only and malaria will decrease and spontaneously disappear if these conditions of the insect host remain the same.*<sup>1</sup>

<sup>1</sup>The same thing will hold if the malaria has been reduced in the community, by a change of biologic conditions of its *Anopheles*, to a certain stationary amount. It will, after the flare-up from the introduction of carriers, spontaneously return to the same degree of infection.

For malaria to disappear from inability of the insect host to continue it, the mechanism must be such that from, say, 1,000 infected men, less than that number, say 800, receive infection. From 800, then, about 640 would be infected, and from 640, about 512, and so on. Obviously, no matter what the number of infections with which we start, we would have a decreasing series which would ultimately reach a number "of no sanitary importance."

It would be inaccurate to say that the rate of decrease in England is from 15,000 to 326 per annum. On the one hand, a number of relapses will occur in 1919 and 1920 among the cases already imported, which will infect others in addition to the 326, and, on the other hand, when the soldiers are demobilized they will live less commonly in camps in the country where *Anopheles* most abound, and their house contact with other people will be less intimate than it is in barracks.

We are awaiting with much interest to see what the reports for, say, 1919 to 1922 will reveal. A number of men infected with malaria have been demobilized and will scatter more widely than they have done heretofore. An attempt was made to free them from infection, but this effort must have been far from 100 per cent effective. Although their house contact will be less intimate than it was in barracks, yet neither these men nor those infected from them will be under anything like the same medical supervision which they were under even in 1917. I am inclined to think the rapidity of the spontaneous decrease of malaria—I have no doubt of its decrease, but alas, I know it will not be left to itself—will depend mainly on the temperatures of the summers in England for the next few years, i. e., whether they will be warm enough to allow of (1) sufficient production of *Anopheles* and (2) of sufficient development of the parasite in the mosquito to continue a fair percentage of the infection.

The present condition is not without parallel. There was a large importation of infected men in 1855, 1856, and 1857 from the Crimea. Angus MacDonald, in the paper quoted, states that the summers of 1857, 1858, and 1859 were unusually hot, and that malaria occurred in epidemic form in those years. It quickly disappeared after 1860, when summer temperatures became normal.

Although awaiting with much interest further reports, I think there is no reason to doubt the spontaneous disappearance of malaria in England, or rather its reduction to a degree of "no sanitary importance." The same thing would happen, after a temporary outbreak, if a large number of carriers were introduced into many parts of the United States in which malaria formerly prevailed, but which are now free from it *because of a change in the biologic conditions of its Anopheles*.